

CHEMISTRY

at the University of Pittsburgh

*THE ACS-CERTIFIED CHEMISTRY MAJOR, AND THE CHEMISTRY MAJOR WITH OPTIONS IN BIOSCIENCE,
BUSINESS, COMMUNICATIONS, EDUCATION, MATERIAL SCIENCE AND PHOTONICS*

Introduction

Chemistry is the most central of sciences. It is involved in natural processes occurring in living things, the earth, the oceans, and the atmosphere. The chemical industry provides materials to feed, clothe and house mankind, drugs to combat disease, and processes to provide energy for societal needs. Chemistry is playing an ever-increasing role in our society, particularly in high technology fields such as molecular biology, microelectronics, drug design and ceramics.

B.S. Degrees in Chemistry

The basic chemistry degree includes A&S General Education Requirements, core chemistry courses, and electives. These electives include undergraduate research in collaboration with departmental faculty and courses in frontier areas of chemistry and related fields. We also offer **special options** for students with specific interests in combining chemistry with other subjects, such as Bioscience. These options, involve additional courses in the chosen second discipline, together with an allowed waiver of selected required science courses. These elective courses will allow you to focus some free credits into a sequence that will give you an in-depth introduction to the subject, and will be directly relevant to your career goals. We stress that none of these special options requires more than 120 credits to graduate.

Jobs and Professional School

The basic Bachelor of Science degree in chemistry prepares you for a career in business or industry, or for advanced study in chemistry. Combined with core biology courses, the Chemistry major is frequently selected as the preferred major for admission to the graduate health professions, including medical and dental school. In combination with the education option, the chemistry major is prepared to enter a certification program leading to a career in secondary science teaching. Chemists at all levels of training have a wide variety of industrial and corporate career opportunities: in agricultural chemistry, food chemistry, environmental science, petrochemicals, pharmaceuticals, semiconductors and electronics, fine chemicals, as well as in basic research. Many opportunities are available for chemistry majors with skills in business (sales, technical marketing, management), communications (technical writing, journalism), and material science (nanoscience, research and development, production and manufacturing). The Option programs are specifically designed to meet the demand for professionals trained in these and other interdisciplinary areas.

Advising/Declaration of Major

You may call George C. Bandik, Director of Undergraduate Studies at 412-624-8212, Room 107 Chevron Science Center for an advising appointment or for additional information. Declaration of major should be done in the A&S Advising Center, 252 Thackeray, 412-624-6444.

THE ACS CERTIFIED CHEMISTRY MAJOR

The chemistry major curriculum meets American Chemical Society degree requirements for certification and provides a rigorous, comprehensive background in the four primary areas of Chemistry, and in elective areas of your choosing. This program is appropriate for students going on to advanced study in Chemistry, as well as for many preprofessional students and students planning careers in industry, and research.

Course Requirements

The following *chemistry* courses are required for the regular Chemistry Major:

CHEM 0110, 0120, or 0710, 0720 - General Chemistry I and II
CHEM 0250, 0260 - Introductory Analytical Chemistry and Lab
CHEM 0310, 0320, or 0730, 0740 - Organic Chemistry I and II
CHEM 0330, 0340, or 0330, 0750 - Organic Chemistry Laboratory I and II
CHEM 1130 - Inorganic Chemistry
CHEM 1140 - Advanced Inorganic Laboratory
CHEM 1250 - Instrumental Analysis
CHEM 1255 - Instrumental Analysis Laboratory
CHEM 1410, 1420 - Physical Chemistry I and II
CHEM 1430, 1440 - Physical Chemistry Laboratory I and II

Other *natural science* courses that are required:

MATH 0220, 0230, 0240	Analytical Geometry and Calculus I, II and III
PHYS 0174, 0175	Basic Physics for Science and Engineering I and II
PHYS 0219	Basic Laboratory Physics for Science and Engineering

In addition, at least **two** credits of *chemistry or science electives* must be taken, usually in the senior year. In order to receive ACS certification the elective requirement **MUST** be met with BIOSC 1000-Biochemistry. Other possible electives can be found on the following list. (For additional information, consult with the Undergraduate Program Office in 107 Chevron Science Center).

Some courses satisfying the Science Elective requirement

CHEMISTRY:

CHEM 1210	Digital Electronics (2 cr.)
CHEM 1260	Intermediate Analytical Chemistry (2 cr.)
CHEM 1270	Special Topics in Instrumental Analysis I (2 cr.)
CHEM 1280	Special Topics in Instrumental Analysis II (1 cr.)
CHEM 1310	Synthetic Organic Chemistry (2 cr.)
CHEM 1380	Techniques of Organic Research (2 cr.)
CHEM 1450	Molecular Modeling & Graphics (3 cr.)
CHEM 1460	Introduction to Modern Computational Science (3 cr.)
CHEM 1480	Intermediate Physical Chemistry (3 cr.)
CHEM 1600	Synthesis and Characterization of Polymers (3 cr.)
CHEM 1605	Synthesis and Characterization of Polymers Lab (1 cr.)
CHEM 1700	Undergraduate Research Seminar (1 cr.)
CHEM 1710	Undergraduate Research (variable cr.)
CHEM 1720	Undergraduate Teaching Experience (variable cr.)

Any chemistry course numbered above 2000, except 2700.

NON-CHEMISTRY:

BIOSC: 0350, 0370, 1000, 1500, 1810, 1820, 1850, 1940

CS: 0441, 0445

GEOL: 1001, 1500

MATH: 0250 or STAT: 1000

IDEAL PROGRAM FOR ACS CERTIFIED CHEMISTRY MAJORS^a

	FALL	credits	SPRING	credits
Freshman Year	CHEM 0110 (or 0710)	4	CHEM 0120 (or 0720)	4
	MATH 0220	4	MATH 0230	4
	ENGCMP	3	GER 2	3
	GER 1 ^b	3	GER 3	3
	FS 1	1		
	Total	15	Total	14

	FALL	credits	SPRING	credits
Sophomore Year	CHEM 0310 (or 0730)	3	CHEM 0320 (or 0740)	3
	CHEM 0330	1	CHEM 0340 (or 0750)	1
	MATH 0240	4	PHYS 0175	4
	PHYS 0174	4	PHYS 0219	2
	GER 4	3	GER 5	3
			GER 6	3
	Total	15	Total	16
Junior Year	CHEM 1410	3	CHEM 1420	3
	CHEM 0250	3	CHEM 1430	1
	CHEM 0260	1	CHEM 1250	3
	GER 7	3	CHEM 1255	1
	Language ^c	4-5	CHEM 1700 ^d	1
			Language ^c	4-5
			GER 8	3
	Total	14-15	Total	16-17
Senior Year	CHEM 1130	3	CHEM 1140	2
	CHEM 1440	1	CHEM W course	1
	SCI ELECT ^e	2	GER 11	3
	GER 9	3		
	GER 10	3		
	Total	12	Total	6

- a. All of the required courses are offered each Fall and Spring Term, and many during the Summer Sessions. Any reasonable alternative sequence of courses is acceptable, as long as prerequisites are met. **Total credits required for the BS degree is 120.**
- b. GER are the School of Arts and Sciences General Education Requirements.
- c. If A&S requirements are not satisfied by advanced standing.
- d. Highly recommended but not required.
- e. At least two credits of Science Electives must be taken to fulfill the requirements of the major. They may be taken at any time (see page 2). For the ACS certified major this elective must be BIOSC 1000.

HONORS PROGRAMS:

Honors Courses - CHEM 0710, 0720, 0730, 0740 and 0750 are honors alternatives to the traditional programs of general and organic chemistry. Questions concerning these honors courses should be addressed to Professor Peter Siska (pes@pitt.edu, 412-624-8640) or Professor Joseph Grabowski (joeg@pitt.edu, 412-624-8632). Note that these are NOT required for Departmental Honors.

To receive *Departmental Honors*, you must have an overall QPA of at least 3.00 and a Chemistry QPA of at least 3.25. You must take at least two credits of CHEM 1710 or CHEM 1720 and one credit of CHEM 1711.

Questions concerning the Departmental Honors Option should be addressed to George C. Bandik (412-624-8212).

CURRICULAR OPTIONS

SPECIAL TRACKS IN CHEMISTRY (see 1st page) ARE AVAILABLE. EACH ALLOWS CHEM 1140, 1440 AND THE TWO-CREDIT SCIENCE ELECTIVE REQUIREMENT TO BE WAIVED. THE ADDED COMPONENTS OF EACH TRACK ARE OUTLINED BELOW.

Bioscience Option*

The combination of chemistry and bioscience is crucial for an understanding of living matter and its metamorphosis through growth, reproduction, aging, disease, and evolution. Experts in the chemistry of living systems spearhead research to combat disease by prevention, cure, and eradication. The Chemistry/Bioscience option includes the core bioscience courses and an introduction to molecular biology, environmental biology and biochemistry. A chemistry degree supplemented by bioscience courses has long been one of the most successful routes leading to the graduate health professions, including medical and dental school. The Bioscience Option is also appropriate for students planning to go on to graduate school in chemistry, biochemistry and related subjects. Industrial career opportunities for chemists with training in the biological sciences are burgeoning in areas such as nutrition, pharmaceuticals, genetic engineering, environmental science and fine chemicals.

***Students following the Bioscience Option can receive ACS certification by taking Chem 1140-Advanced Inorganic Laboratory as part of their undergraduate degree requirements.**

Courses (14 credits).

A.	BIOSC 0150, 0050, 0160, 0060	Foundations of Biology and Lab	8
B.	Any <i>two</i> courses chosen from:		6
	BIOSC 0350	Genetics	
	BIOSC 0370	Ecology	
	BIOSC 1000	Biochemistry	
	BIOSC 1030	Commercial Microbiology	
	BIOSC 1500	Cell Biology	
	BIOSC 1810	Macromolecular Structure and Function	
	BIOSC 1850	Microbiology	
	BIOSC 1940	Molecular Biology	

NOTE: PHYS 0110, 0111, 0212 are acceptable alternatives to PHYS 0174, 0175, and 0219 in this Option.

Business Option

A large proportion of chemistry graduates become involved in chemical or instrumentation sales, technical marketing, or management. Chemistry majors interested in careers in these fields have two alternatives for including business coursework in their undergraduate program. The A&S/Business Dual Major allows a student to earn full majors in both chemistry and business. Information on this program is available in the A&S Advising Center, 252 Thackeray Hall, and the College of Business Administration Advising Office in 2606 Sennott Square.

The second alternative is a Business Option within the chemistry major. This combination may enhance employment opportunities for entry-level positions in business, industry, and research organizations. The Business Option includes the core chemistry courses and required elective courses in business.

Courses (15-18 credits).

Note that an additional waiver for the Business Option is CHEM 1420.

A.	ECON 0100 or 0110	Micro or Macroeconomics	3
B.	BUSERV 1920	Financial Accounting	3
C.	BUSERV 1925	Cost Accounting	3

D. Any three courses from the following list of selected CBA courses. 6-9:

BUSERV 1910	Introduction to Business
BUSERV 1915	Introduction to Management
BUSERV 1955	Principles of Selling
BUSERV 1980	The Legal Environment of Business
BUSERV 1985	Small Business Management
BUSMKT 1040*	Introduction to Marketing

In lieu of a third course from the above list, one course may be selected from the following list of marketing electives. These courses require BUSMKT 1040 Introduction to Marketing as a prerequisite.

BUSMKT 1411*	Marketing Research
BUSMKT 1441*	Consumer Behavior

* These courses are A&S/Business Dual Major courses and require special permission from Liz Adams at the Undergraduate Program Office, College of Business Administration, 2606 Sennott Square. Because business majors have priority in registering for these courses, you should contact the office very early in the registration process.

George C. Bandik (Room 107, Chevron Science Center) must approve all applicants for the Business Option. Only those students will be given override slips for the Business courses. If you must be placed on a waiting list, every effort will be made to admit you to the class early in the add-drop period before the term begins, but admission to a course cannot be guaranteed.

Material Science Option

There is a great demand in both industry and education for chemists trained in material science. As molecular biology, microelectronics, high performance materials and nanotechnology become increasingly important in our society, demand for material scientists will also increase. The Material Science Option is designed to provide a fundamental background and laboratory experience with synthetic and naturally occurring materials. This is appropriate for chemists going on to graduate study in Chemistry or Material Science, or directly to careers in industry (fundamentals or applications research, analysis, etc.).

Courses (10 credits).

A.	ENGR 0022	Materials Structure and Property	3
B.	CHEM 1600	Synthesis and Characterization of Polymers	3
C.	CHEM 1605	Synthesis and Characterization of Polymers Lab	1
D.	CHEM 1620	Atoms, Molecules and Materials	3

Communications Option

Informative, accurate science communication is needed at both the technical and the popular level, for example in training materials, advertising, scientific journals, newspapers, TV and radio. The Chemistry/Communications Option includes an introduction to linguistics, writing, and mass communication. This Option makes available unique job opportunities in industry: in technical writing and editing, in marketing, in advertising, in scientific journalism, and in education.

Courses (12 credits).

A.	ENGCMP 0400	Written Professional Communication	3
B.	Any <i>three</i> courses chosen from:		9
	COMMRC 0320	Mass Communication Process	
	COMMRC 1105	Television and Society	
	ENGWRT 1310, 1320	Newspaper I, II	
	ENGWRT 1330, 1340	Nonfiction I, II	
	ENGWRT 1394	Science Writing	
	LING 0080	Aspects of Language	

The Education Option

The demand for qualified science and math teachers in today's technology based society is ever increasing. The chemistry education option will allow students to earn the B.S. in chemistry and then apply to the one year professional certification program offered through the School of Education. Students also need to take the PRAXIS I: Reading, Writing, Mathematics exam prior to applying for admission to the certification program. Application forms are available in 5500 Posvar Hall. The option will also prepare students to enter the Master of Arts in Teaching Program (MAT) here at the University of Pittsburgh.

The Education Option (*continued*)*Courses (13 credits)*

A.	BIOSC 0050/0150	Foundations of Biology I and Lab	4
B.	ADMPS 1001	Social Foundations of Education	3
C.	I and L 1430	Intro to Science Education	3
D.	PSYED 1001 or 1003	Educational Psy or Adolescent Psy	3

NOTE: PHYS 0110, 0111, 0212 are acceptable alternatives to PHYS 0174, 0175, and 0219 for this option.

The Photonics Option

The photonics industry crosses the boundaries of spectroscopy, imaging, displays, and optical communications- the "high tech" world. There is strong overlap with chemistry, since modern chemistry involves numerous photonic techniques, including lasers, photon counting, nonlinear optics methods such as four-wave mixing, and ultrafast (femtosecond) time resolution. The photonics option allows students to learn cutting-edge photonics methods in physics and electrical engineering. Students may also continue on to earn the Certificate in Photonics by taking additional courses (see the website www.phyast.pitt.edu/~snoke/photonics).

Courses (12 credits)

A.	PHYS 1361	Wave Motion and Optics	3
B.	<i>One of the following courses:</i>		3
	EE 1259	Electromagnetics	
	PHYS 1225	Analog and Digital Electronics	
	PHYS 1351	Intermediate Electricity and Magnetism	
C.	CHEM 1470	Photonics I	3
D.	CHEM 1472	Photonics II	3